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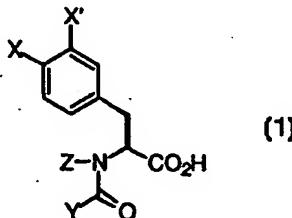
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(54) Title: N-ALKANOYLPHENYLALANINE DERIVATIVES



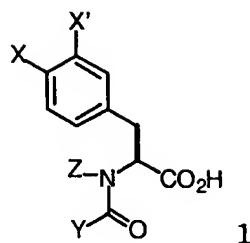
(57) Abstract

Compounds of formula (1) as well as their salts and esters are disclosed wherein X, X', Z and Y are as described in the specification and which have activity as inhibitors of binding between VCAM-1 and cells expressing VLA-4. Such compounds are useful for treating diseases whose symptoms and/or damage are related to the binding of VCAM-1 to cells expressing VLA-4.

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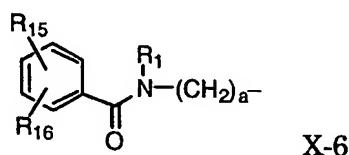
Claims

1. A compound of the formula:



5 wherein:

one of X and X' is hydrogen, halogen, or lower alkyl, the other is a group of the formula:



wherein:

10 R₁ is hydrogen or lower alkyl,

R₁₅ is halogen, nitro, lower alkyl sulfonyl, cyano, lower alkyl, OH, lower alkoxy, lower alkoxy carbonyl, carboxy, lower alkyl aminosulfonyl, perfluorolower alkyl, lower alkylthio, hydroxy lower alkyl, alkoxy lower alkyl, halo lower alkyl, alkylthio lower alkyl, alkylsulfinyl lower alkyl, alkylsulfonyl

15 lower alkyl, lower alkylsulfinyl, lower alkanoyl, aroyl, aryloxy or a group of the formula R₁₇-C≡C-,

R₁₆ is hydrogen, halogen, nitro, cyano, lower alkyl, OH, perfluorolower alkyl, or lower alkylthio,

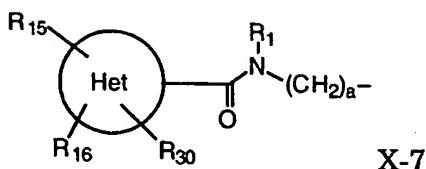
R₁₇ is hydrogen, aryl, heteroaryl, or lower alkyl which is unsubstituted or

20 substituted by OH, aryl, or heteroaryl, and

a is 0 or 1;

or one of X and X' is a group of the formula:

- 114 -



wherein Het is a 5- or 6-membered heteroaromatic ring containing 1, 2 or 3 heteroatoms selected from N, O, and S;

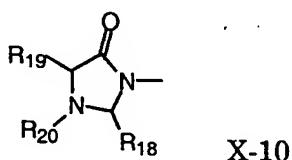
or

5 Het is a 9- or 10-membered bicyclic heteroaromatic ring containing 1, 2, 3 or 4 heteroatoms selected from O, S, and N,

a, R₁, R₁₅ and R₁₆ are as above, and

R₃₀ is hydrogen or lower alkyl, or is absent;

or one of X and X' is a group of the formula:



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wherein:

R₁₈ is lower alkyl, aryl, heteroaryl, arylalkyl, heteroaryl alkyl,

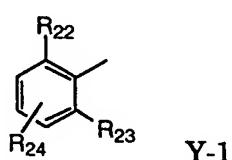
15 R₁₉ is lower alkyl, which is unsubstituted or substituted by one or more of halogen, hydroxy, lower alkoxy, aryl, heteroaryl, alkylthio, or R₁₉ is aryl or heteroaryl, and

R₂₀ is lower alkyl or lower alkanoyl, or

R₁₉ and R₂₀ taken together are tetramethylene;

and

Y is a group of the formula:

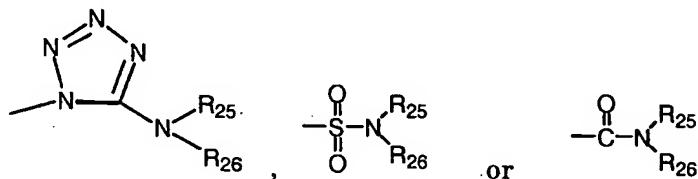


20

wherein:

R₂₂ and R₂₃ are independently hydrogen, lower alkyl, lower alkoxy, lower alkoxylalkyl, lower alkylamino, aryl, arylalkyl, nitro, cyano, lower alkylthio, lower alkylsulfinyl, lower alkyl sulfonyl, lower alkanoyl, halogen, or 5 perfluoroalkyl and at least one of R₂₂ and R₂₃ is other than hydrogen, and

R₂₄ is hydrogen, hydroxy, lower alkyl, lower alkoxy, amino, aryl, nitro, cyano, lower alkyl sulfonyl, halogen, or is a group of the formula:



wherein R₂₅ is hydrogen, lower alkyl, aryl, aryl lower alkyl, alkoxy lower 10 alkyl and R₂₆ is hydrogen or lower alkyl, or

R₂₂ and R₂₄ taken together are a fused benzene ring; or

Y is a group Y-2 which is a five or six membered monocyclic heteroaromatic group containing 1, 2 or 3 heteroatoms selected from N, O, and S, or a 9- or 10-membered bicyclic heteroaromatic group containing 1, 2, 3 or 4 15 heteroatoms selected from O, S, and N, wherein said heteroaromatic group is bonded via a carbon atom to the amide carbonyl and one or two carbon atoms of said heteroaromatic group are substituted by lower alkyl, halogen, cyano, perfluoroalkyl, or aryl and at least one of said substituted carbon atoms is adjacent to the carbon atom bonded to the amide carbonyl;

20 and the pharmaceutically acceptable salts and esters thereof.

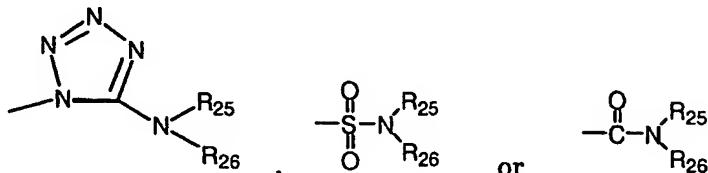
2. A compound according to claim 1, wherein Z is hydrogen.

3. A compound according to claim 1 or 2, wherein X' is hydrogen.

4. A compound according to any one of claims 1-3, wherein:

R₂₂ and R₂₃ are independently hydrogen, lower alkyl, nitro, lower alkylthio, 25 lower alkoxy, lower alkylamino, lower alkylsulfinyl, lower alkyl sulfonyl, lower alkanoyl, halogen, or perfluoroalkyl wherein at least one of R₂₂ and R₂₃ is not hydrogen, and

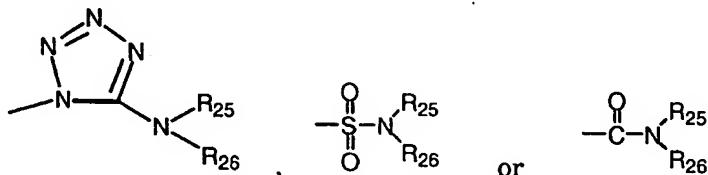
R₂₄ is hydrogen, hydroxy, lower alkyl, lower alkoxy, lower alkylsulfonyl, amino, nitro, halogen or a group of the formula:



wherein R₂₅ is aryl lower alkyl and R₂₆ is hydrogen or lower alkyl,
5 or R₂₂ and R₂₄ taken together are a fused benzene ring.

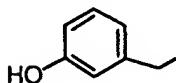
5. A compound according to claim 4, wherein R₂₂ is hydrogen (when R₂₃ is other than hydrogen), lower alkyl or halogen.

6. A compound according to claim 4 or claim 5, wherein R₂₄ is hydrogen, hydroxy, lower alkylsulfonyl, lower alkyl, halogen, nitro or lower alkoxy or a
10 group of the formula:



wherein R₂₅ is unsubstituted or hydroxy-substituted phenyl lower alkyl, and R₂₆ is hydrogen,
or R₂₂ and R₂₄ taken together are a used phenyl ring.

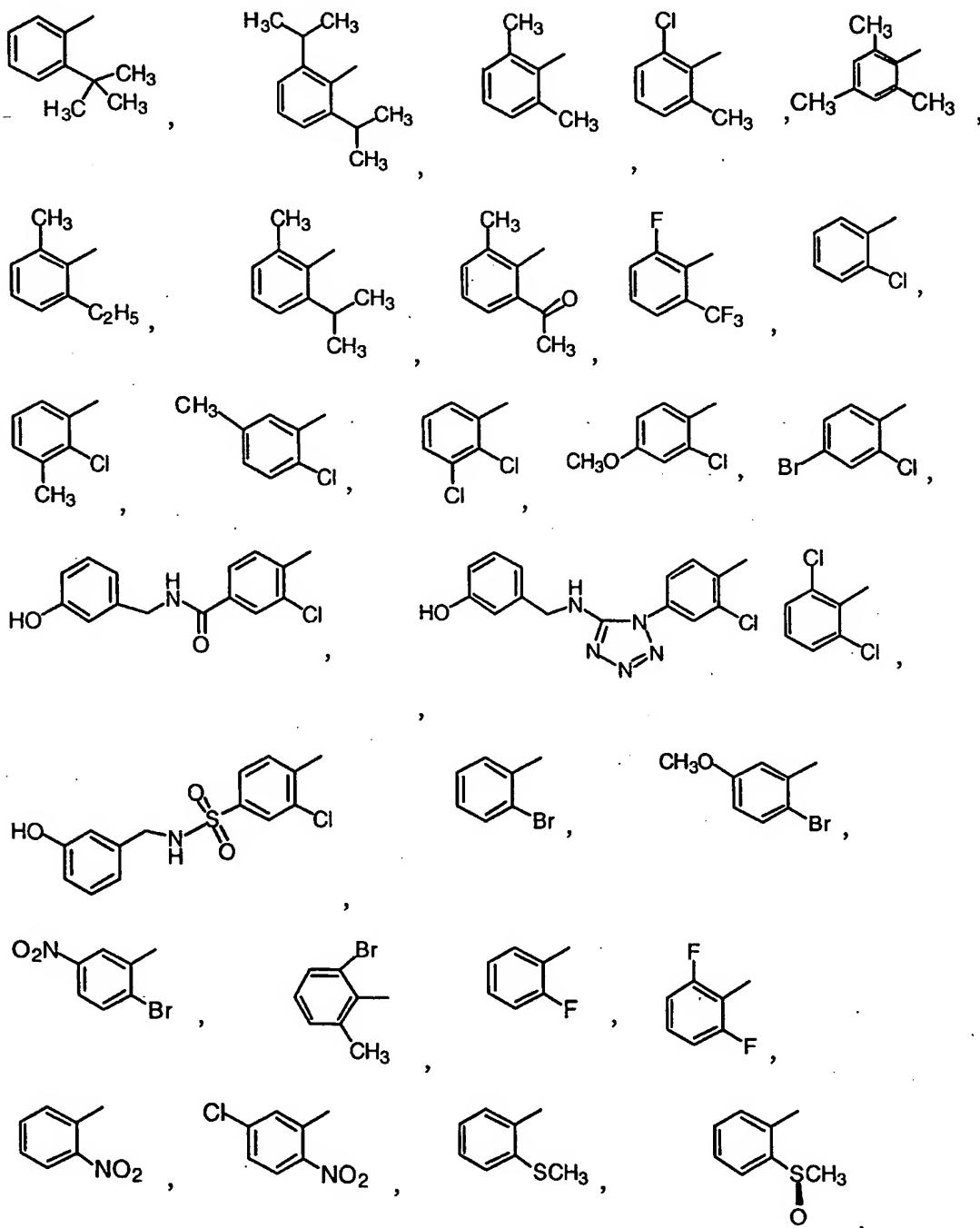
15 7. A compound according to claim 6, wherein R₂₄ is hydrogen, hydroxy, amino, methyl, chloro, bromo, nitro, -OCH₃, -SO₂CH₃ and R₂₆ is H and R₂₅ is

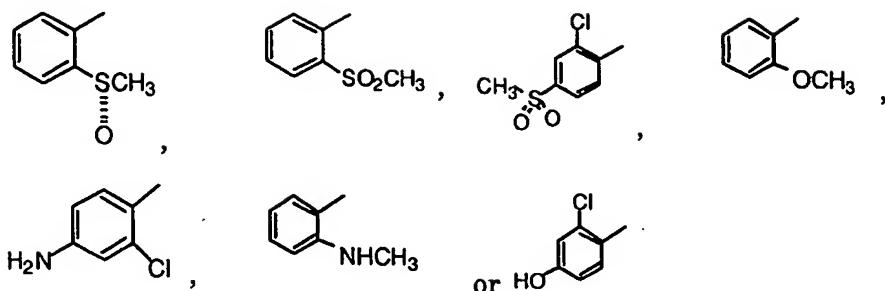


8. A compound according to any one of claims 4-7, wherein R₂₃ is hydrogen (when R₂₂ is other than hydrogen), lower alkyl, lower alkylamino,
20 halogen, nitro, perfluoro lower alkyl, lower alkoxy, lower alkanoyl, lower alkylsulfinyl or lower alkyl sulfonyl.

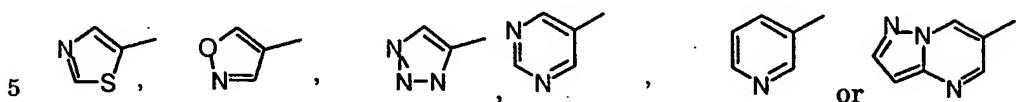
9. A compound according to claim 8, wherein R₂₃ is methyl, ethyl, isopropyl, tertbutyl, trifluormethyl, chloro, bromo, fluoro, nitro, -COCH₃, -SCH₃, -SOCH₃, -SO₂CH₃, -NHCH₃ or -OCH₃.

10. A compound according to any one of claims 4-9, wherein Y-1 is
5 selected from the group consisting of:

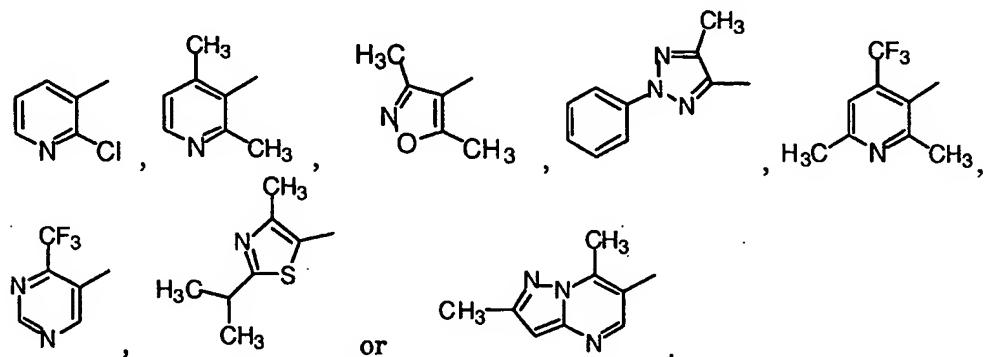




11. A compound according to any one of claims 1-3, wherein in Y-2 the monocyclic heteroaromatic or the 9- or 10-membered bicyclic heteroaromatic groups are selected from the group of:



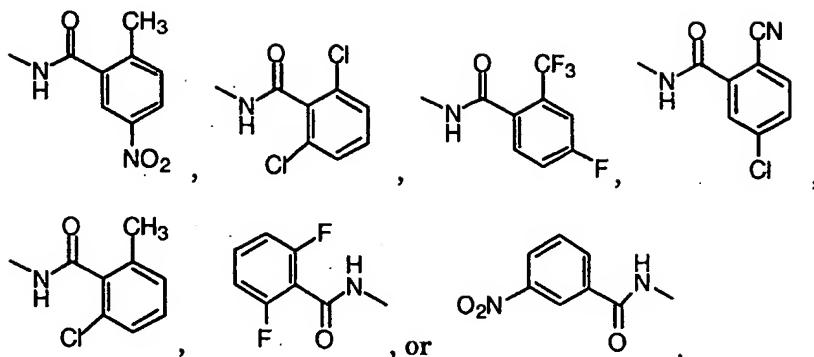
12. A compound according to claim 11, wherein groups Y-2 are of the formula:



10 13. A compound according to any one of claims 1-3, wherein in X-6 the groups R₁₅ and R₁₆ independently hydrogen lower alkyl, nitro, halogen, perfluoroloweralkyl, cyano or aryloxy.

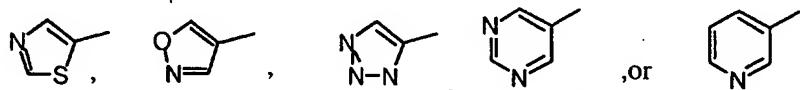
14. A compound according to claim 13, wherein R₁₅ or R₁₆ is H, methyl, nitro, chloro, fluoro, trifluormethyl, cyano or phenoxy.

15 15. A compound according to claim 13 or claim 14, wherein group X-6 is of the formula:



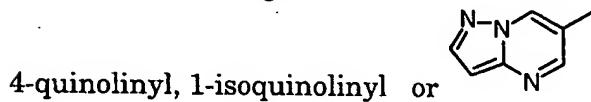
16. A compound according to any one of claims 1-3, wherein in X-7 Het is a 5- or 6-membered monocyclic heteroaromatic ring containing 1, 2 or 3
5 nitrogens, or a nitrogen and a sulfur, or a nitrogen and an oxygen.

17. A compound according to claim 16, wherein the heteroaromatic ring is



18. A compound according to any one of claims 1-3, wherein in X-7 Het is a bicyclic heteroaromatic ring containing from 1 to 3 nitrogens as the
10 heteroatoms.

19. A compound according to claim 18, wherein the bicyclic heteroaromatic ring is



20. A compound according to any one of claims 1-3, wherein in X-7 R₁₅ is
15 hydrogen, nitro, lower alkyl sulfonyl, cyano, lower alkyl, lower alkoxy, perfluorolower alkyl, lower alkylthio, lower alkanoyl, or aryl.

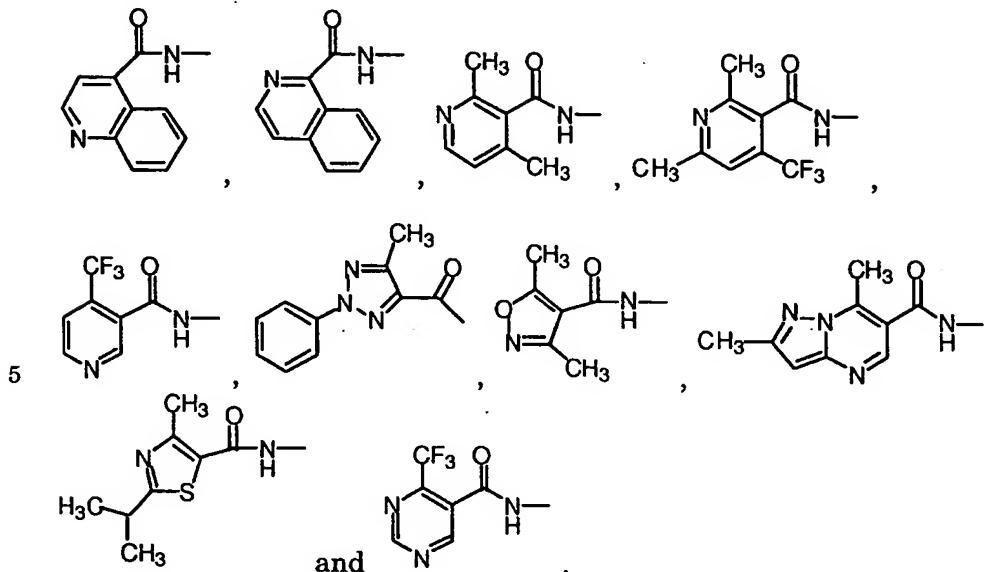
21. A compound according to claim 20, wherein R₁₅ is isopropyl, methyl or phenyl.

22. A compound according to any one of claims 1-3, wherein R₁₆ in X-7 is
20 hydrogen, halogen, nitro, cyano, lower alkyl or perfluoro lower alkyl.

23. A compound according to claim 22, wherein R₁₆ is methyl or trifluoromethyl.

24. A compound according to any one of claims 1-3, wherein R₃₀ in X-7 is hydrogen or lower alkyl.

25. A compound according to any one of claims 1-3, wherein groups X-7 are of the formula:



26. A compound according to any one of claims 1-3, wherein in X-6 or X-7 R₁ is hydrogen

27. A compound according to any one of claims 1-3, wherein in X-6 or X-7 10 a is 0.

28. A compound according to any one of claims 1-3, wherein in X-10 R₁₈ is lower alkyl or phenyl wherein the phenyl ring is unsubstituted or monosubstituted by halogen, hydroxy or is phenyl lower alkyl.

29. A compound according to claim 28, wherein R₁₈ is tertbutyl, phenyl, 15 phenoxy, chlorophenyl or phenylethyl.

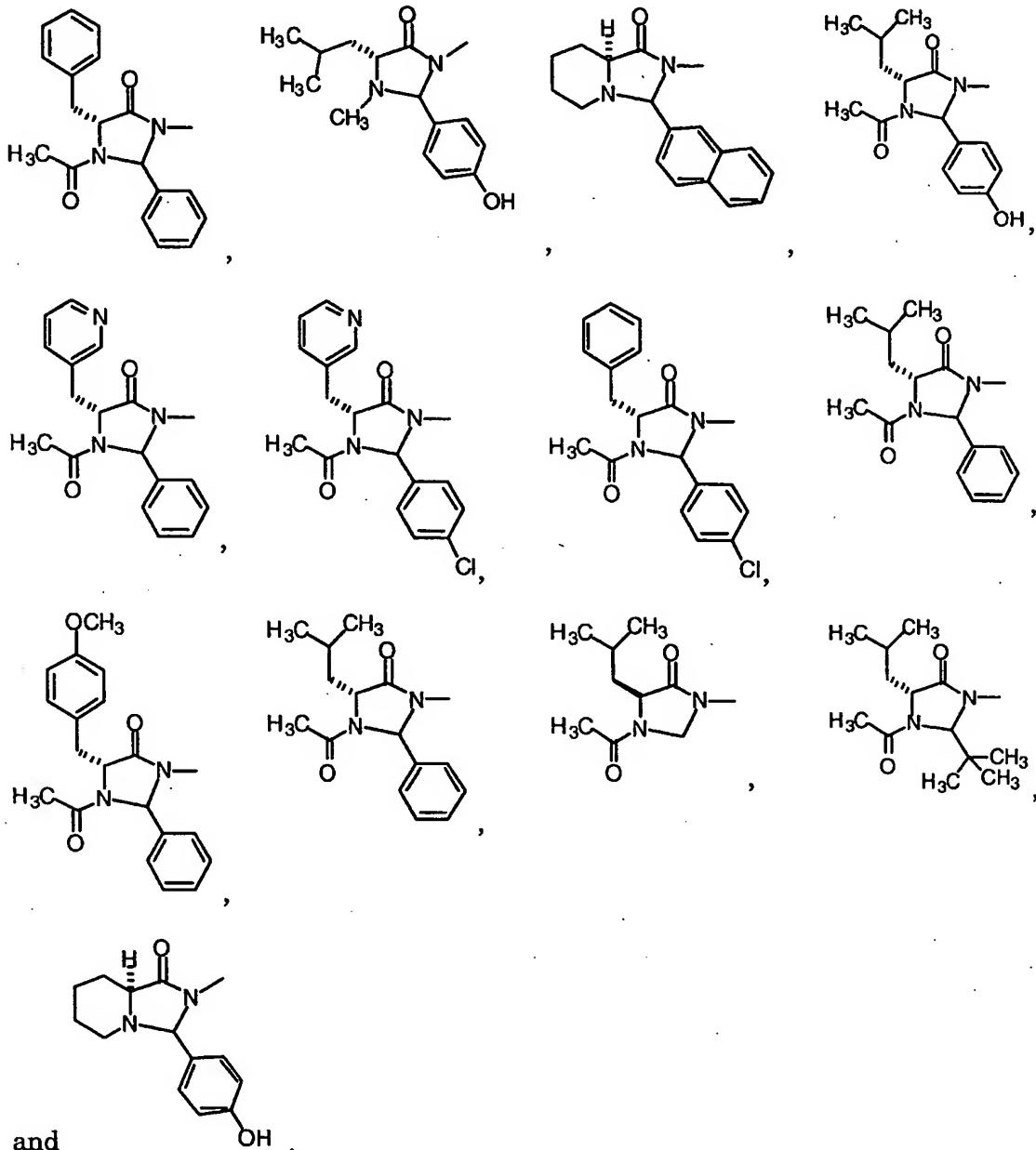
30. A compound according to any one of claims 1-3, wherein in X-10 R₁₉ is lower alkyl which is unsubstituted or substituted by pyridyl or phenyl wherein the phenyl ring is unsubstituted or monosubstituted by lower alkoxy or halogen.

20 31. A compound according to claim 30, wherein R₁₉ is methyl, isobutyl, benzyl, 4-chlorobenzyl, 4-methoxybenzyl or 2-pyridylmethyl.

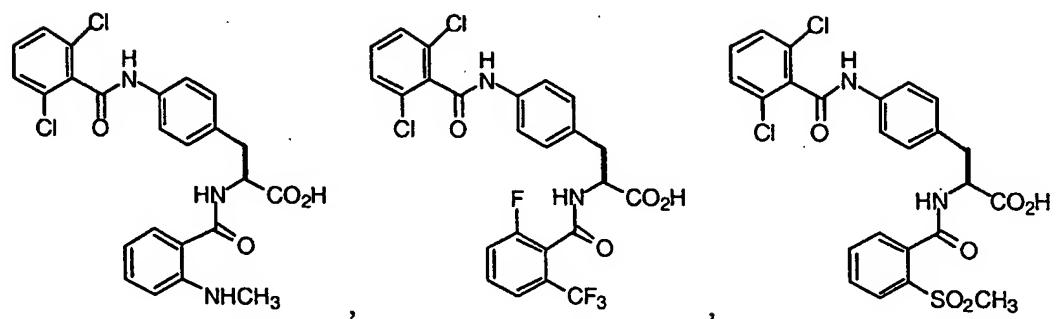
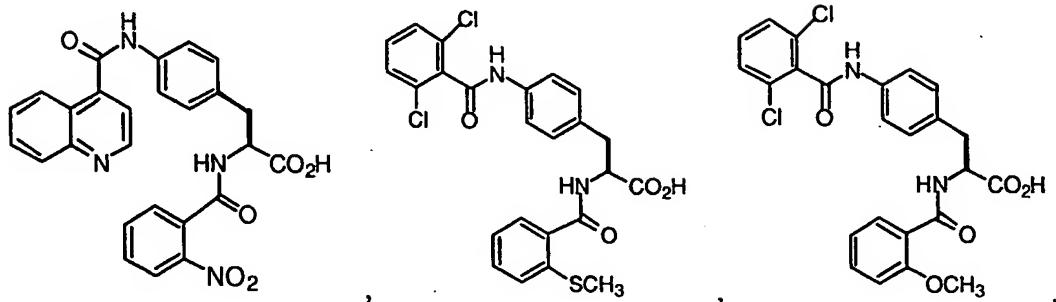
32. A compound according to any one of claims 1-3, wherein in X-10 R₂₀ is lower alkanoyl.

33. A compound according to claim 32, wherein R₂₀ is acetyl.

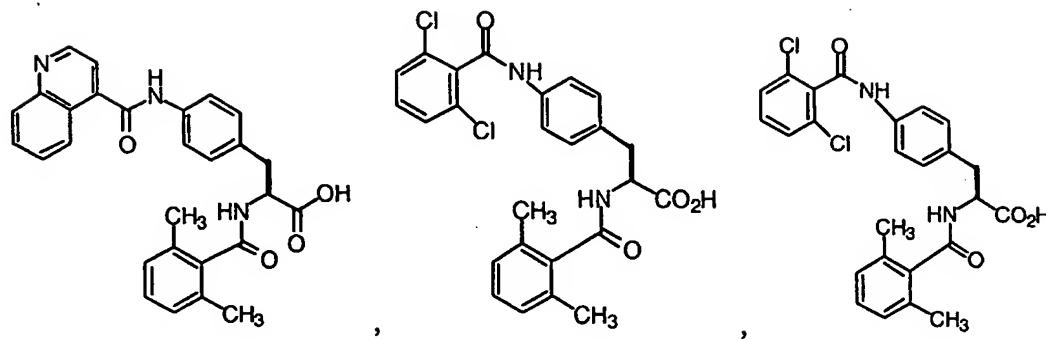
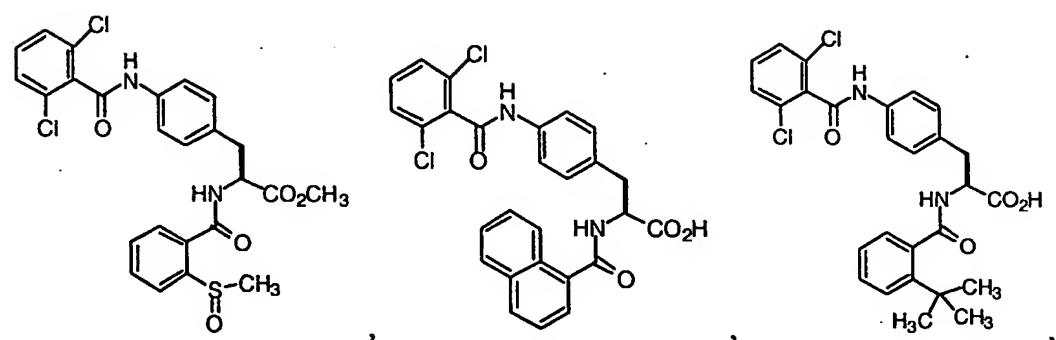
34. A compound according to any one of claims 1-3, wherein groups X-10 are of the formula:

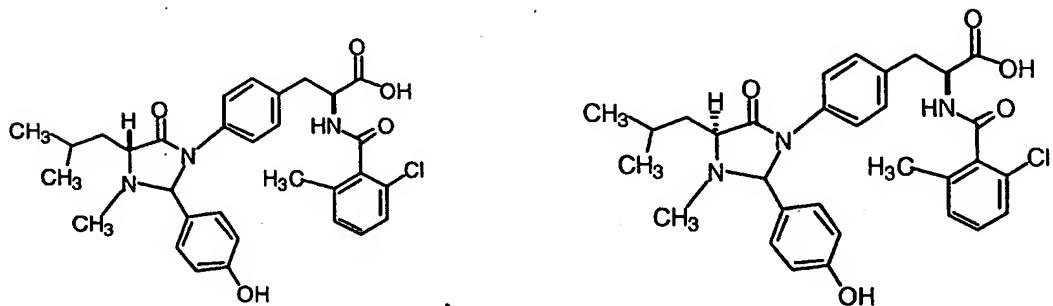
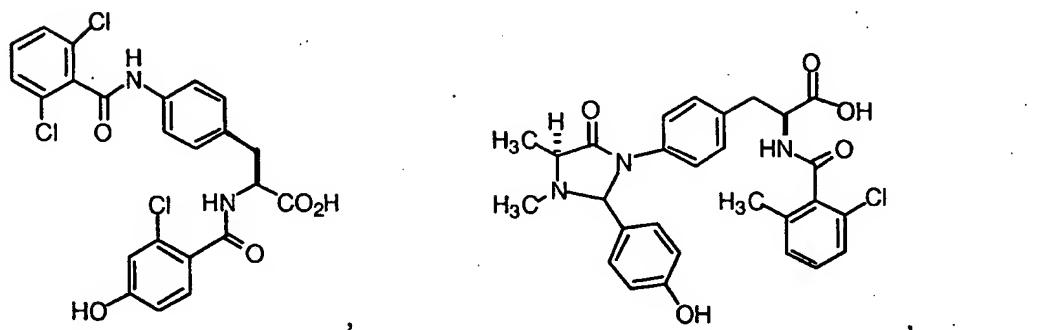
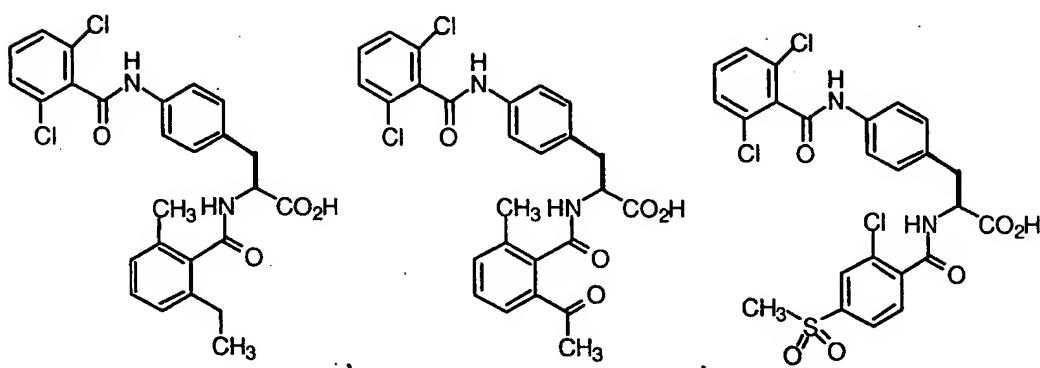
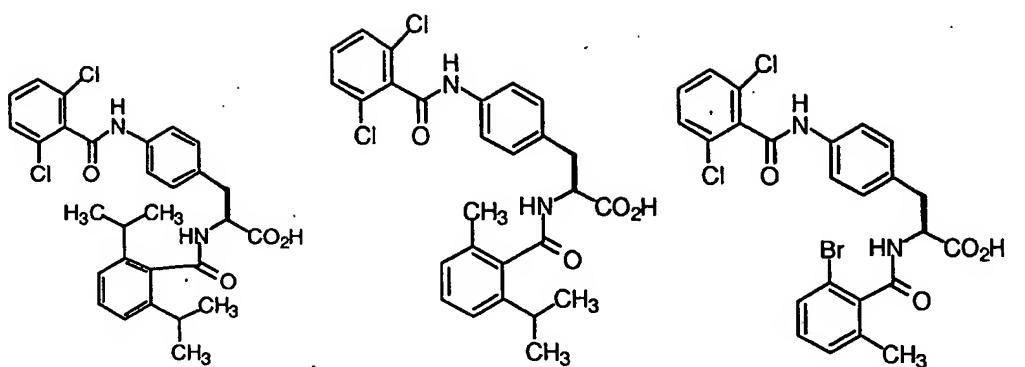


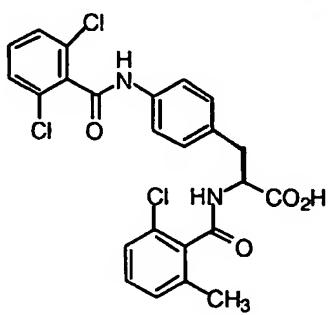
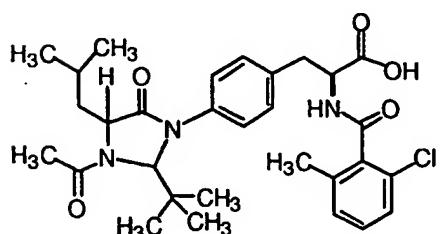
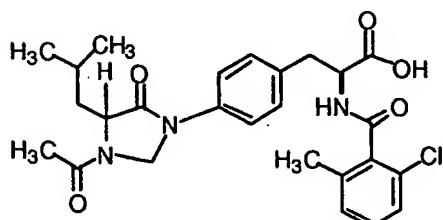
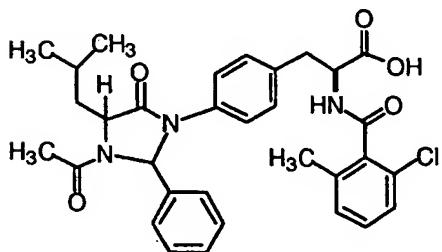
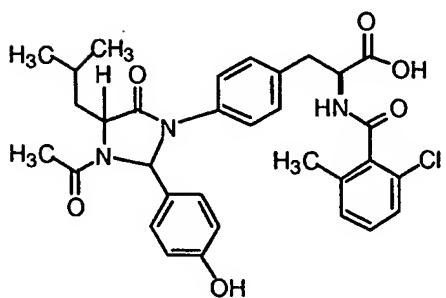
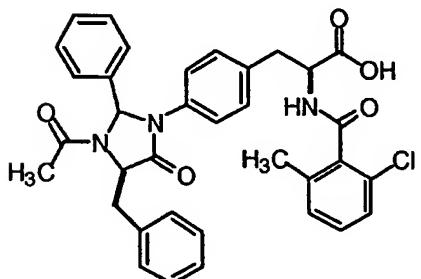
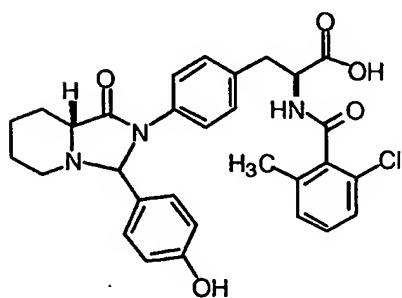
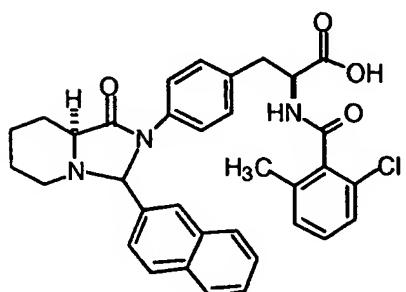
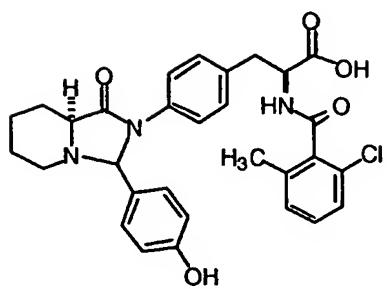
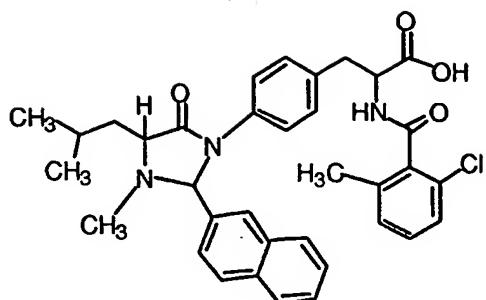
35. A compound selected from the group:

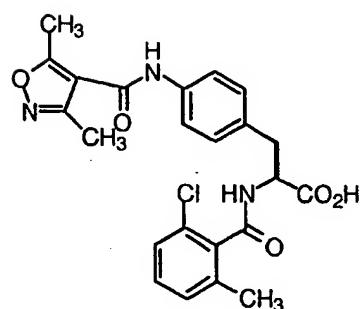
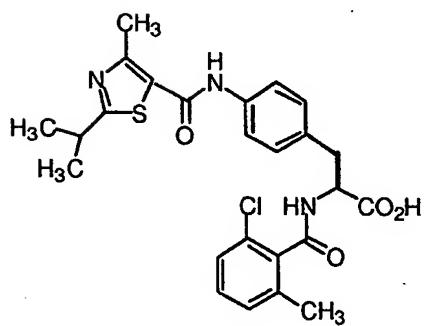
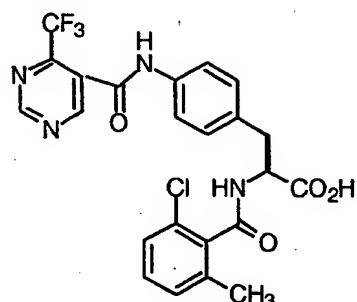
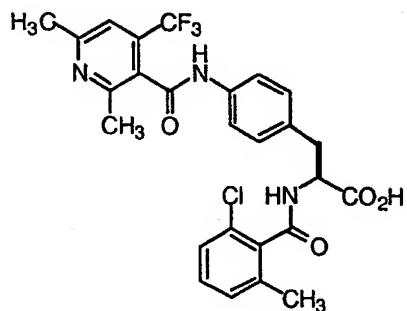
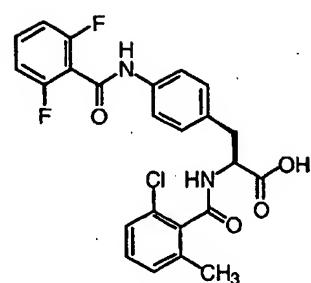
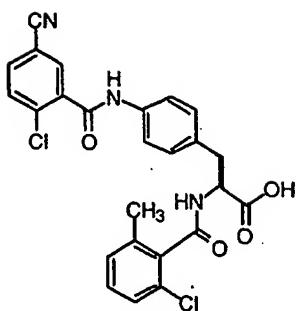
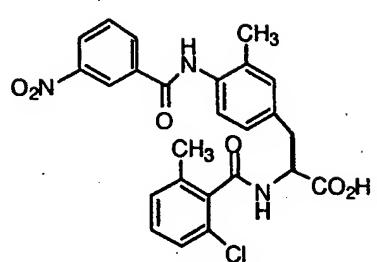


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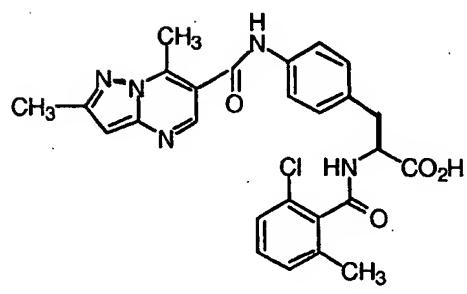
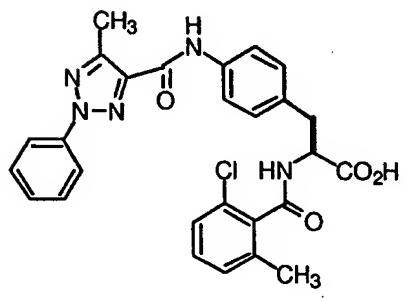


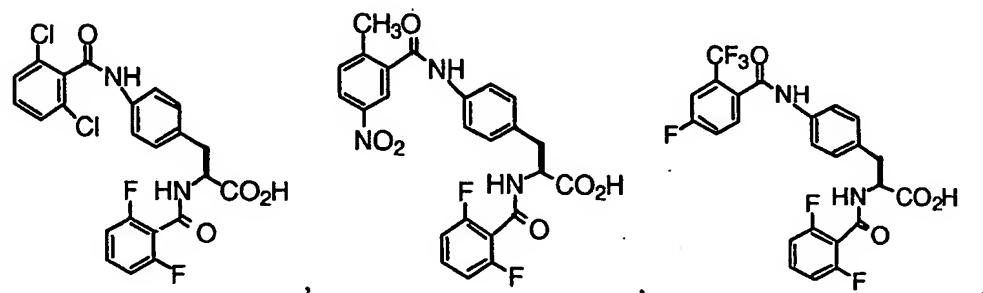
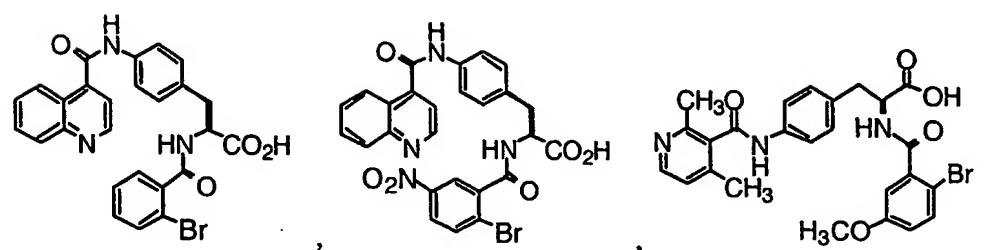
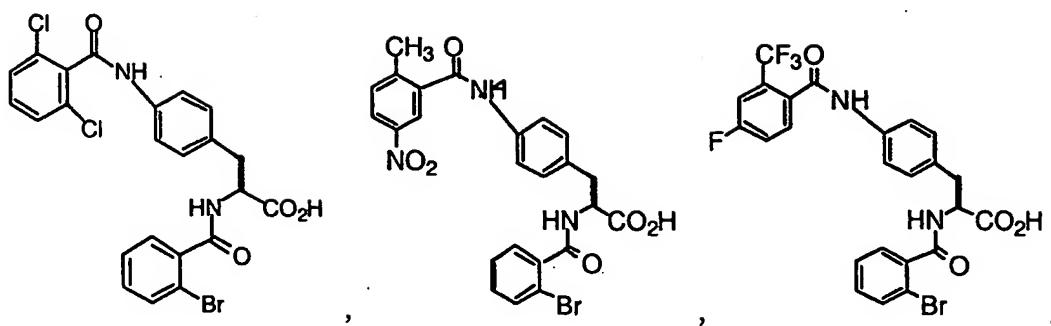


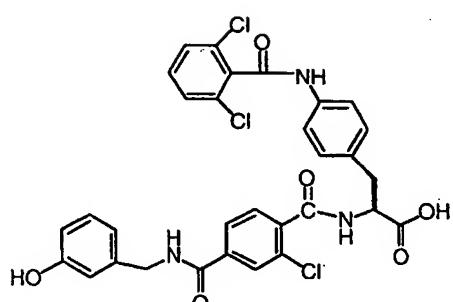
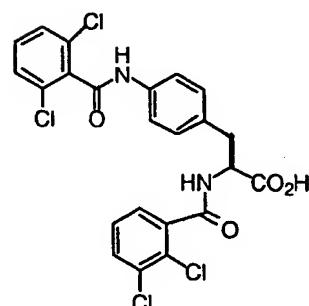
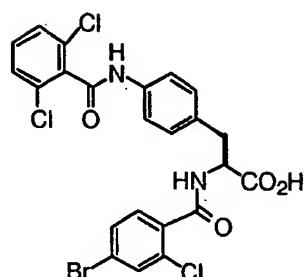
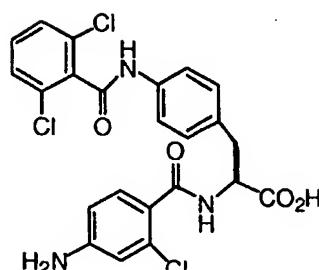
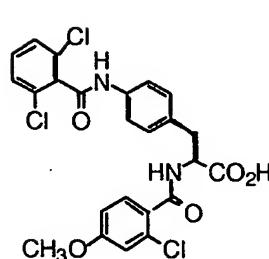
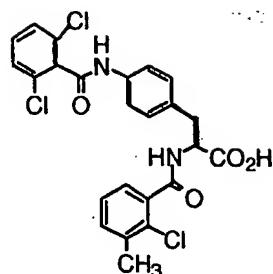
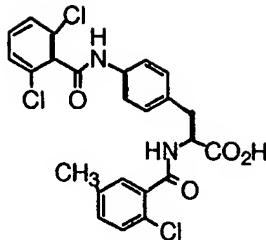
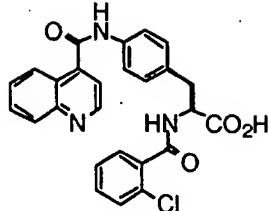




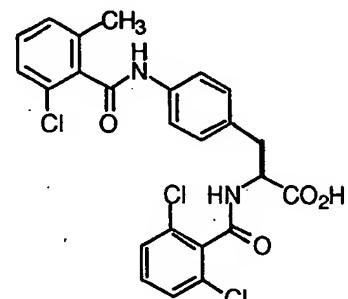
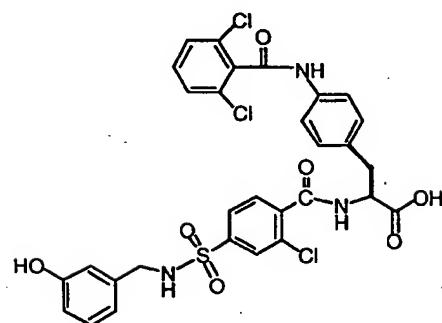
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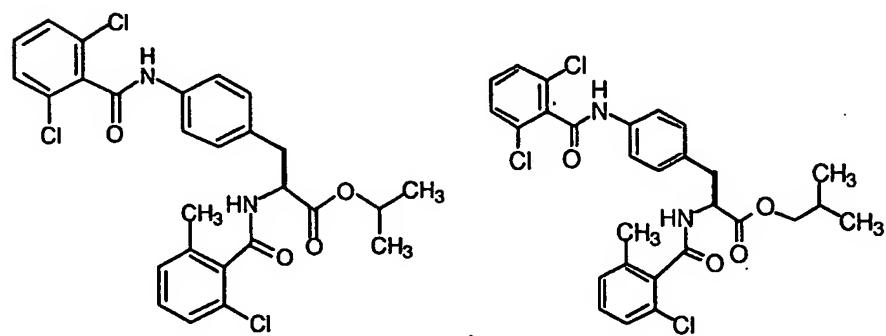
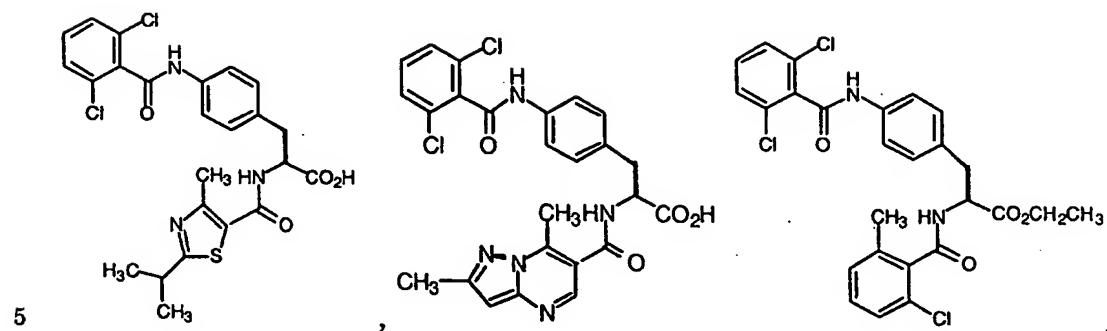
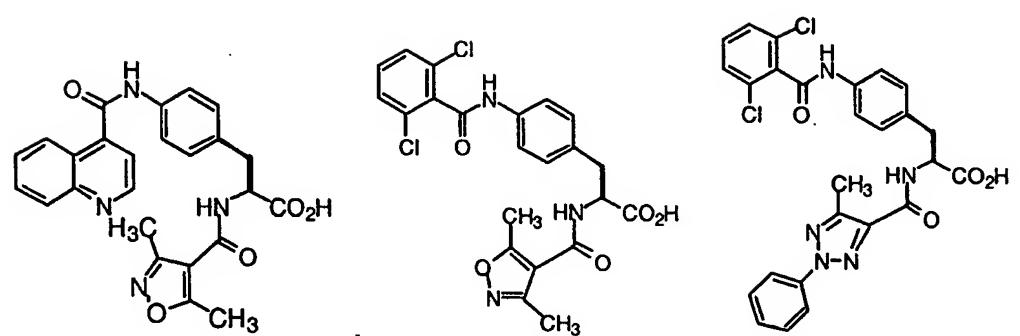
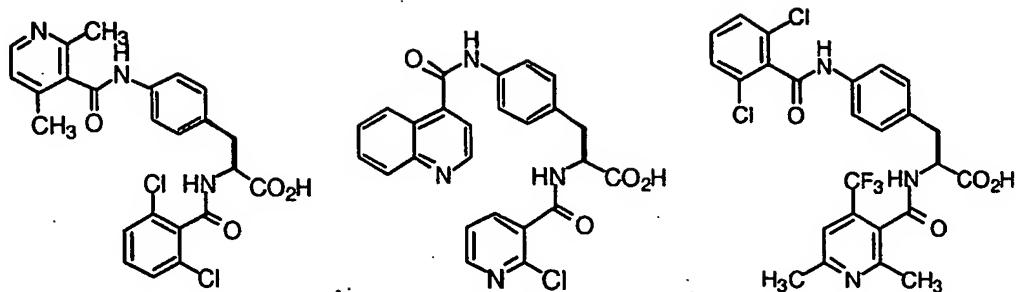




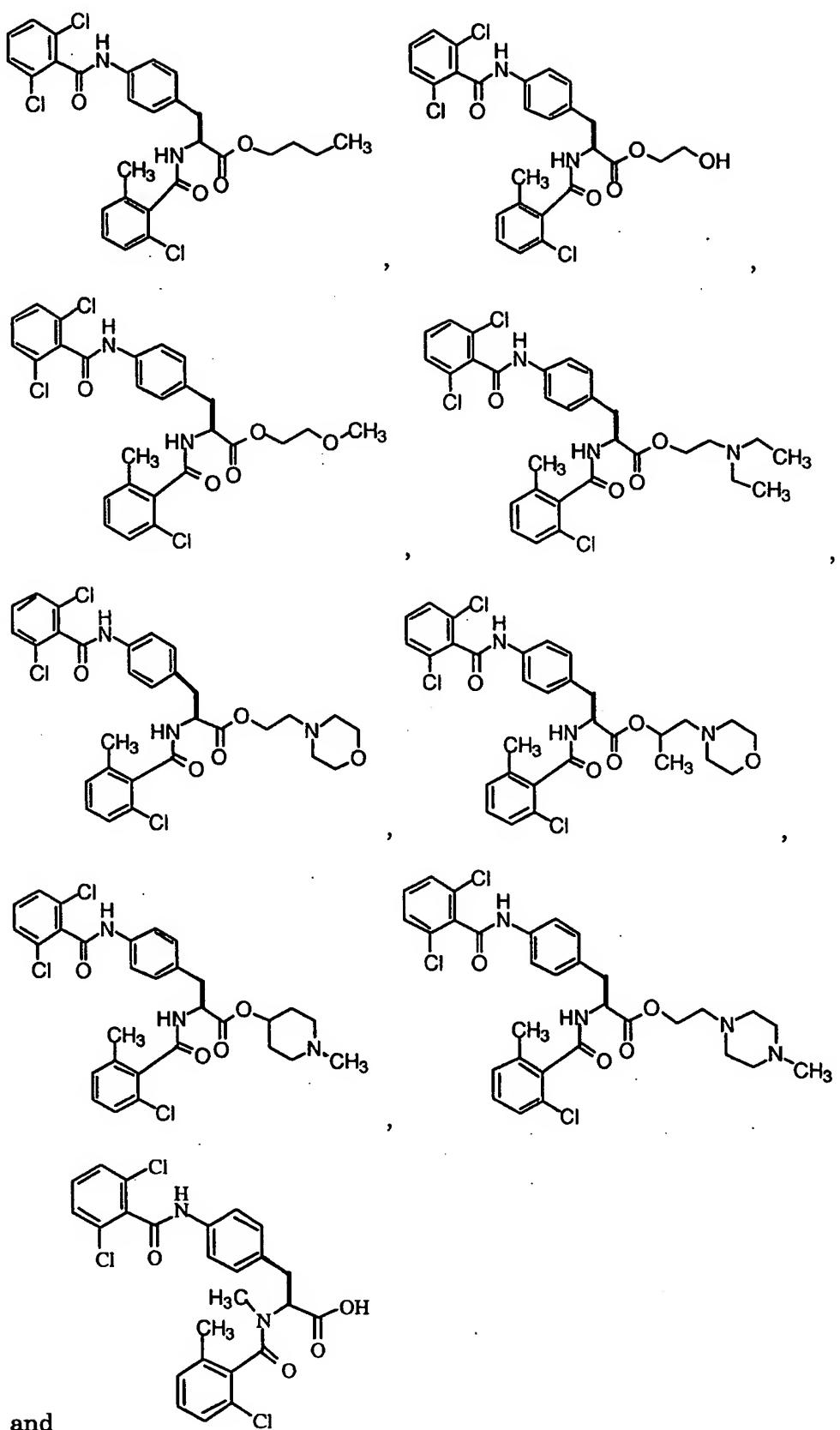


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36. Compounds according to any one of the claims 1-35 for use as a medicament.

37. Compounds according to any one of the claims 1-35 for use as a medicament in the treatment of rheumatoid arthritis, multiple sclerosis, 5 inflammatory bowel disease or asthma.

38. A medicament containing a compound according to any one of claims 1-35 and a therapeutically inert carrier material.

39. A medicament for the treatment of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease or asthma, containing a compound 10 according to any one of claims 1-35 and a therapeutically inert carrier material.

40. A process for the production of a medicament, especially for the treatment of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease or asthma, which process comprises bringing a compound according to 15 any one of claims 1-35 into a galenical administration form together with a therapeutically inert carrier material and, if desired, one or more additional therapeutically active substances.

41. The use of a compound according to any one of claims 1-35 in the treatment of illnesses, especially in the treatment of rheumatoid arthritis, 20 multiple sclerosis, inflammatory bowel disease or asthma.

42. Use of a compound according to any one of claims 1-35 in the preparation of a medicament for the treatment of rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease or asthma.

43. The novel compounds, intermediates, processes, medicaments and 25 methods as hereinbefore described.

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